PATENT COOPERATION TREATY

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INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference P0796	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/GB 03/00027	International filing date *(day/month/year)* 07.01.2003	Priority date *(day/month/year)* 07.01.2003
International Patent Classification (IPC) or both national classification and IPC E21B47/12		
Applicant SPRING, Gregson, William, Martin		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 5 sheets, including this cover sheet.

   ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of 2 sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the opinion
   - II ☐ Priority
   - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
   - VI ☐ Certain documents cited
   - VII ☐ Certain defects in the international application
   - VIII ☐ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
30.07.2004	06.09.2004
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized Officer Morrish, S Telephone No. +49 89 2399-7220

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/GB 03/00027

I. Basis of the report

1. With regard to the **elements** of the international application *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17))*:

Description, Pages

1-4, 6-28	as originally filed
5	received on 30.07.2004 with letter of 28.07.2004

Claims, Numbers

4-20	as originally filed
1-3	received on 30.07.2004 with letter of 28.07.2004

Drawings, Sheets

1/14-14/14	received on 11.03.2003 with letter of 10.03.2003

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

   These elements were available or furnished to this Authority in the following language: , which is:

   ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).

   ☐ the language of publication of the international application (under Rule 48.3(b)).

   ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

   ☐ contained in the international application in written form.

   ☐ filed together with the international application in computer readable form.

   ☐ furnished subsequently to this Authority in written form.

   ☐ furnished subsequently to this Authority in computer readable form.

   ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

   ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

   ☐ the description, pages:

   ☐ the claims, Nos.:

   ☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).

   (Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-20
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-20
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-20
	No:	Claims	

2. Citations and explanations

   see separate sheet

The examination is being carried out on the following application documents:

Text for the Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IT LI LT LU LV MC MK NL PL PT RO SE SI SK TR

Description, pages: 1-4,6-28, as originally filed
5, as received on 28/07/2004, with letter of 30/07/2004

Claims, No.: 4-20, as originally filed
1-3, as received on 28/07/2004, with letter of 30/07/2004

Drawings, sheets: 1/14-14/14, as received on 10/03/2003, with letter of 11/03/2003

V - Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

Document **D1: WO 02/12676**, which is considered the closest prior art to the subject-matter of **claim 1**, discloses (see in particular pages 6 and 7) a communication system for downhole use comprising a drill collar (21) comprising a first portion and a second portion separated from each other by an electrically insulating material (22) and means for generating an electrical signal (43) and for applying the electrical signal to the drill collar such that the electrical signal is transmitted into a geological formation being drilled, whereby the means for generating the electrical signal comprises an alternator (page 17, line 21).

The subject-matter of **claim 1** differs from this known D1 in that a means is mechanically connected to the alternator, said means being responsive to an electrical output of the alternator for regulating rotation of the alternator.

Therefore the subject-matter of **claim 1** is new and meets the requirements of Article 33(2) PCT with respect to novelty.

The problem to be solved by the current application is that of regulating the output of

the alternator in order that the electrical power provided is suitable for the sensitive instrumentation used in downhole applications. Although **D2: US-A-4 739 325** discloses a down-hole electrical power generator which includes a drill string driving an alternator, both D1 and D2 use electronic methods of regulating this power output. Electronic control methods can also be affected by certain downhole conditions and are therefore considered as unreliable in these conditions. As this problem is solved by claim 1 by a means (such as torque generator) mechanically attached to the alternator in order that the rotation of the alternator is regulated, the subject-matter of **claim 1** meets the requirements of the PCT with respect to inventive step.

As **claims 2 to 20** are dependent on claim 1, they also meet the corresponding requirements of the PCT with respect to novelty and inventive step.

CLAIMS

1. A communication system for down hole use and comprising a drill collar (101) comprising a first portion (103) and a second portion (105) separated from each other by an electrically insulating material (67) and means (22, 63, 77, 81) for generating an electrical signal and for applying the electrical signal to the drill collar (101) such that the electrical signal is transmitted into a geological formation being drilled, characterised in that the means for generating the electrical signal comprises an alternator (22, 63, 77, 81) and means (2, 4, 10) mechanically connected to the alternator, the means (2, 4, 10) being responsive to an electrical output of the alternator for regulating rotation of the alternator.

2. A communication system as claimed in claim 1, characterised in that the means responsive to the electrical output of the alternator comprises a torque generating apparatus (2, 4, 10) which generates torque in response to the electrical output of the alternator and transmits such torque to the alternator for regulating rotation thereof.

3. A communication system as claimed in claim 2, characterised in that the torque generating apparatus comprises a first assembly (10, 25) including a generally cylindrical member of magnetically soft material and having a longitudinal axis, a second assembly (2) arranged coaxially within the first assembly and including an electromagnetic winding (4), the first assembly and the second assembly being rotatable relative to each other about the axis, the arrangement being such that relative rotation between the first and second assemblies induces a magnetic field which generates rotational torque between the first and second assemblies.

in response to the linear flow of the mud down the centre of the drill string.

All mud alternators effectively run open loop. This means that the output voltage of the mud alternator is entirely dependant on the mud flow rate and is zero when there is no mud flow and at a maximum when the mud flow is at its maximum. This highly variable output voltage characteristic is completely unsuitable for drilling instrumentation, and especially unsuitable for use in electromagnetic telemetry techniques.

It is an object of the present invention to provide a communication system capable of fulfilling at least some of the above requirements.

According to the present invention there is provided a communication system for down hole use and comprising a drill collar comprising a first portion and a second portion separated from each other by an electrically insulating material and means for generating an electrical signal and for applying the electrical signal to the drill collar such that the electrical signal is transmitted into a geological formation being drilled, wherein the means for generating the electrical signal comprises an alternator and means mechanically connected to the alternator, the means being responsive to an electrical output of the alternator for regulating rotation of the alternator.

The means responsive to the electrical output of the alternator may comprise a torque generating apparatus which generates torque or a torque reaction in response to the electrical output of the alternator and which transmits such torque to the alternator for regulating rotation thereof.